X

NPTEL

Courses » **Introduction to Non-linear Optics and its Applications**

Announcements   **Course**   Ask a Question   Progress   Mentor   FAQ

Unit 7 - Week 5

Course outline

How to access the portal

Pre-requisite Assignment

Week 1

Week 2

Week 3

Week 4

Week 5

● Lecture 21 : Birefringence phase-matching (BPM),Type I and Type II phase matching

● Lecture 22 : Type II phase matching, Symmetry in nonlinear susceptibility

● Lecture 23 : Kleinman's Symmetry, Neumann's Principle

● Lecture 24 : Neumann's Principle (cont) Centrosymmetric system

● Lecture 25 : Matrix form : SHG, SFG, DFG , SHG in KDP Crystal

○ Quiz : Wee 5 Assignment 5

○ Feedback for Week 5

Week 6

Week 7

Week 8

Week 9

Week 10

Wee 5 Assignment 5

The due date for submitting this assignment has passed.   **Due on 2018-09-12, 23:59 IST.**
As per our records you have not submitted this assignment.

1)   *2 points*

What do you mean by Centro symmetric medium
(a) symmetric under translation (b) symmetric under rotation (c) symm
under inversion

○ (a)

○ (b)

○ (c)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(c)

2)   *2 points*

In Centro symmetric medium which order of susceptibility is non-zero?
(a) $\chi^{(2)}$ (b) $\chi^{(3)}$ (c) $\chi^{(4)}$ (d) $\chi^{(6)}$

○ (a)

○ (b)

○ (c)

○ (d)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(b)

3)   *2 points*

Under inversion operation the first order susceptibility $\chi_{ij}^{(1)}$ transf
as $\left(\text{Matrix for inversion is given by } R = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix} \right).$

(a) $\chi_{ij}'^{(1)} = -\chi_{ij}^{(1)}$ (b) $\chi_{ij}'^{(1)} = \chi_{ij}^{(1)}$.   (c) $\chi_{ij}'^{(1)} = 0$ (d) none of these

○ (a)

○ (b)

(b)

4)   *2 points*

Under symmetric transformation$\bar{4}$, the relation between d_{111} and d_{222} is

$\left(\text{Matrix represntation of } \bar{4} = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & -1 \end{bmatrix} \right).$

(a) $d_{222} = d_{111}$ (b) $d_{222} = -d_{111}.$ (c) $d_{222} = 2d_{111}$ (d) none of these

- ( ) (a)
- ( ) (b)
- ( ) (c)
- ( ) (d)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(a)

5)   *2 points*

Right down the rotation matrix for 120° rotation about the z axis

(a) $\begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} & 0 \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} -\frac{1}{2} & -\frac{\sqrt{3}}{2} & 0 \\ -\frac{\sqrt{3}}{2} & \frac{1}{2} & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (c) $\begin{bmatrix} -\frac{1}{2} & -\frac{\sqrt{3}}{2} & 0 \\ -\frac{\sqrt{3}}{2} & -\frac{1}{2} & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} -\frac{1}{2} & \frac{\sqrt{3}}{2} \\ -\frac{\sqrt{3}}{2} & -\frac{1}{2} \\ 0 & 0 \end{bmatrix}$

- ( ) (a)
- ( ) (b)
- ( ) (c)
- ( ) (d)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(d)

6)   *2 points*

In case of 3m crystal $d_{13} = 0$. Use this d value and the rotation matrix mentic in Q5 find out the value of d_{23}

(a) 0   (b) $\frac{\sqrt{3}}{2}$ (c) $\frac{1}{2}$ (d) 1

- ( ) (a)
- ( ) (b)
- ( ) (c)
- ( ) (d)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(a)

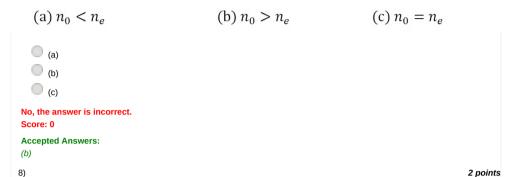7)   *2 points*

The frequency of Ti-sapphire laser beam ($\lambda = 780\,nm$) is doubled in a I crystal. The refractive indices are defined as

$$n_0^2 = 2.7405 + \frac{0.0184}{\lambda^2 - 0.0179} - 0.0155\lambda^2 \quad \text{and} \quad n_e^2 = 2.3730 + \frac{0.0128}{\lambda^2 - 0.0156} - 0.004$$

where the wavelengths are in μm. The relation between n_0 and n_e for the ab mentioned wavelength is

(a) $n_0 < n_e$ (b) $n_0 > n_e$ (c) $n_0 = n_e$

- ○ (a)
- ○ (b)
- ○ (c)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(b)

8)   *2 points*

For Q7 find the phase matching angle for type I ($o + o \rightarrow e$)

(a) 29.78°   (b) 0.52°   (c) 0.25°   (d) 14.29°

- ○ (a)
- ○ (b)
- ○ (c)
- ○ (d)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(a)

9)   *2 points*

Under principle axis system, the d matrix of the KDP crystal is given

$$d = \begin{pmatrix} 0 & 0 & 0 & d_{14} & 0 & 0 \\ 0 & 0 & 0 & 0 & d_{25} & 0 \\ 0 & 0 & 0 & 0 & 0 & d_{36} \end{pmatrix}$$. Here $d_{25} \approx 0.45\ pm/V$. Now the crystal is rotated along

z-axis with an angle of $\pi/4$. In the new coordinate system the value of d_{25}

(in pm/V) is

(a) 0.45   (b) 0   (c) 0.225   (d) 0.318

- ○ (a)
- ○ (b)
- ○ (c)
- ○ (d)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(b)

10)   *2 points*

Under principle axis system, the d matrix of the KDP crystal is given

$$d = \begin{pmatrix} 0 & 0 & 0 & d_{14} & 0 & 0 \\ 0 & 0 & 0 & 0 & d_{25} & 0 \\ 0 & 0 & 0 & 0 & 0 & d_{36} \end{pmatrix}$$. Here $d_{14} \approx 0.23$ pm/V. Now the crystal is rotated along

z-axis with an angle of $2\pi/3$. In the new coordinate system the value of d_{14}

(in pm/V) is

(a) 0   (b) 0.115   (c) −0.115   (d) −0.23

○ (a)

○ (b)

○ (c)

○ (d)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(c)

Previous Page   End